THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 405.)

CCCCXV.—WHEELING.

Wheeling, West Virginia, in lat. 40° 8′ N., long. 80° 47′ W., on the east bank of the Ohio River, is on the bottom lands where Wheeling Creek empties into the river, and on Zanes Island in the river. It extends four miles along the river, and averages half a mile wide from the river to hills from 250 to 600 ft. high.

Settled in 1782, it was incorporated as a city in 1836. Water-works were built by the city in 1831, taking the supply from the Ohio River.

The suction pipes of the pumps are laid about 100 ft. into the river, and are perforated near the end with 1-in. holes. Two side-lever steam engines, with cylinders of 20-in. diameter and 84-in. stroke, are geared to double-acting piston pumps of 16-in. bore and 120-in. stroke, the engine making two strokes to one of the pump. In 1880 a Worthington duplex high-pressure engine of 29-in. steam and 15-in. water-cylinders of 36-in. stroke was added.

The water is pumped 190 ft. into a reservoir on the hill side 150 ft. above the lowest part of the city, but 25 to 50 ft. below many residences on the hill. It is on rock, and inclosed by masonry walls. It holds 880,000 gallons. Every year from 18 to 24 in. of sediment is removed from its bottom.

Distribution is by cast-iron pipe of from 30 to 3 inches diameter. Many of the smaller pipes have become filled with sediment, and are being replaced by 6 inch pipe. It is estimated that 32½ miles of pipe are in use, with 300 fire hydrants. The number of gates and taps is unknown to anyone. Service pipes are of lead. There are no meters except 13 on hydraulic elevators, and they are not used.

The population in 1880 was 31,186. The daily consumption is estimated at 3,000,000 gallons. The cost of the works and the bonded debt are unknown. No systematic account of expenses was kept prior to 1882. The expenses and receipts for 1880 and 1881 were as follows:

	1880.		1881.	
Pumping expenses	$9,310.39		$14,512.81	
Salaries	5,000.00		5,000 00	
		$14,310.39		$19,512.81
Extensions	12,117.23		54,567.15	
Contingent Expenses	8,303.80		25,783.50	
Total Expenses	$34,731.42		$99,863.46	
Receipts	53,551.89		56,022.46	

The works were formerly managed by a committee of the City Council. There is now a board of control of 3 members elected by the Council.

John Cummings was Superintendent from 1862 to 1878. James H. Riddle is the Superintendent now.

CCCCXVI.—STEUBENVILLE.

Steubenville, Ohio, in lat. 40° 25′ N., long. 80° 43′ W., is on high ground on the right bank of the Ohio River. Low-water mark in the river is 640½ ft. above the sea.

A block house was built at the point in 1876, but the town was not settled until 1797. It was incorporated as a city in 1851, and extended in 1871. The town was supplied with water from springs through wooden pipes prior to 1835, in which year water-works were built by the town, taking the supply from the river and pumping it by a 40 horse-power steam pump three-quarters of a mile, through 8-in. pipe, to a reservoir holding 400,000 gallons, 192 ft. above the river. Another reservoir, holding 600,000 gallons, was afterward built. In 1867, two steam engines, each of 150 horse-power, with plunger pumps, were built by James Means & Co., and a 20-in. force main laid. Two 15-in. pipes, laid 300 ft. out on the river bed, convey the water to the pump well. The supply is taken from the river below where the city drainage enters it.

Distribution is by 13.8 miles of cast-iron pipe, of from 20 to 2-in. diameter, with 109 fire hydrants, 192 gates and 1,725 taps. Service pipes are of lead.

The population in 1880, was 12,017. The daily consumption, in 1881, was 1,300,000 gallons.

The cost of the works is not known. The bonded debt is $12,000 at 5 per cent. The expenses in 1881 were $20,473.80 for maintenance, and the receipts from water rents were $16,750.

The works are managed by three trustees. R. J. Irwin is the superintendent.

CCCCXVII.—PERU, IND.

Peru, Indiana, in lat. 40° 47′ N. long. 86° 6′ W., is on the Wabash River, on level ground extending back about half a mile to bluffs 90 to 100 ft. high. It was settled about 1820. Water-works were built by the city in 1879, after plans of J. D. Cook, C. E., taking the supply from the river. A 20-in. cast-iron pipe conveys the water 370 ft. from a crib in the river to two brick wells 5 ft. in diameter and 22 ft. deep, from which it is pumped by a Worthington compound duplex engine of 1,500,000 gallons daily capacity, and a Worthington high pressure engine of 1,000,000 gallons capacity, through 2,446 ft. of 12-in. pipe, to a reservoir holding 1,250,000 gallons 93 ft. above the pumps, or 116 ft. above the river. Distribution is by cast-iron pipe of from 16 to 4 in. diameter. On May 1, 1880 the date of the latest obtainable statistics, there were 11.8 miles in use, with 101 fire hydrants, 83 gates and 130 taps. It is not known what kind of service pipes are used.

The population in 1880 was 5,280 and the daily consumption 213,000 gallons.

The works cost $111,068.60. The cost of maintenance the first year was $4,872.98 and the revenue $3,844.76. The works are managed by three trustees, elected by the people.

(TO BE CONTINUED.)

ADDITIONS & CORRECTION.—Nov. 11, p. 388 and Nov. 25, p. 405, for *Middleton*, read *Middletown*.

Nov. 18, p. 399. *St. Joseph, Missouri.* L. W. Densmore, corrects the description of the topography as follows: The city lies on the Blacksnake Hills, and a strip of bottom land enclosed between them and the river, not more than 3000 ft. wide at the widest point, about ⅔ of the population residing on the hills, the highest parts of which are about 180 ft. above high water in the river. The city is intersected by two valleys, in one of which, next the reservoir, flows Blacksnake Creek, about 5 miles long. The other valley, at its debouchure from the hills, ⅓ of a mile from the river, has an elevation above the river of about 40 ft., but might be turned by a detour of about 1¼ or two miles.

For *Clew*, Secretary, read CHEW.

The receipt of statistics as follows, is acknowledged with thanks:

From B. Walker Peterson, C. E., statistics and water-rates of the water-works of Wheeling, W. Va.

From Roger P. Atkinson, C. E., statistics of the water-works of the Western N. C. Insane Asylum, Greensboro, N. C.

From A. F. Matlack, City Clerk, statistics and water-rates of the water-works of Steubenville, Ohio.

From T. N. Bartelle, C. E., statistics of the water-works of Fort Dodge, Iowa.

From D. M. Swan, Secretary, statistics and water-rates of the water-works of Leavenworth, Kansas.

From W. E. Pettee, statistics of the water-works of Canaan, Conn., Cheshire, Mass., and Richmond Furnace, Mass.

THE AMERICAN PUBLIC HEALTH ASSOCIATION.

To the Members of the Advisory Council of the American Public Health Association, and other Officers and Members of the Association:

GENTLEMEN: The American Public Health Association, during the ten years of its existence, has given original force and direction to much of that spirit of inquiry as to public health and State medicine in the United States, which now so largely secures public attention. Its mission for good, while still that of popularizing sanitary science and applying sanitary art, has come to demand such expert skill as can define methods with precision and present them with the supports, either of experiment, of fact, of logic or of experience. It is not now so much to insist upon certain things as necessary, as to present and enforce how best to do them. To this end we desire—

I. To arouse the present active membership to such early and specific study as will lead such as offer papers, to give us the results of their patient industry and their careful experience.

II. To induce additional members of State and city boards, who are engaged in health offices in their respective localities, to become members of the Association.

III. To outline so early the chief subjects for our next meeting at Detroit, as to give full time for careful research.

IV. To turn the attention of our membership so earnestly to the needs of a well-sustained National Health Service as shall lead each, in their respective States, to be importunate that there be no curtailment of power and resources in such direction.

To these ends, as your presiding officer for the year, I ask—

I. That the Advisory Council, and other officers, will feel themselves especially charged with the duty of recommending to the Executive Committee, members from their respective States, whose applications the committee may consider at its meeting in February, 1883. The application should state "the business or profession and special qualifications of the person so proposed," and may be sent either to the President or Secretary. Although the membership is large, it is noticeable that some of the States have a small attendance, which can be increased if members of boards of health and the local members of the Advisory Council take the matter specifically in hand.

While physicians naturally form the nucleus of such an association, it is very important that it represent the whole scope of hygiene and of sanitary art.

To this end we ask that you also select from your own State, for recommendation, such educators, engineers, plumbers, architects, chemists, or other scientists, as will aid in illustrating the applications of their specialties to the art of preserving life.

II. That persons desiring to offer papers on any special subject, early apprise us, so that the outline for the year may include such subjects as are approved by the Executive Committee.

III. That the members of the Advisory Council in each State see to it, that by honorable and direct effort their Representatives in the National Congress, are made fully acquainted with the present status of national health administration, and the reasonable provision, both as to law and appropriation, requisite for a proper defense of the national health, "*Salus populi suprema est lex.*" Such welfare not only includes health, but has its protection as a primal idea.

I will be glad to receive any suggestions tending to aid these purposes, and so promote the efficiency of the Association, and will present them to the Executive Committee at its first meeting.

(Signed) EZRA M. HUNT,
President of A. P. H. Association.

TRENTON, Nov. 15, 1882.

ENGINEERS' SOCIETIES.

ENGINEERS' CLUB OF PHILADELPHIA.

ROOMS, NO 1523 CHESTNUT ST., PHILADELPHIA, PA.

Record of Regular Meeting.

November 4, 1882, Past President Frederick Graff in the chair. Twenty members present.

Mr. John Haug, in presenting the club with a copy of Lloyd's Rules for Iron Ships, stated the number and tonnage of ships built in Great Britain in 1881 as follows:

	Built in 1881.			Lost in 1881.	
	Number.	Tonnage.	Material used.	Number.	Tonnage.
Steel steamers	34	68,366	32,000 tons	1	1,536
Steel sailing vessels	3	3,167	1,500 tons		
Iron steamers	411	500,503	300,000 tons	139	138,370
Iron sailing vessels	50	68,950	34,000 tons	52	43,936
Wooden steamers	30	1,659		18	1,704
Wooden sailing vessels	259	16,448		821	168,579
Total	787	748,793		1,031	354,125

The principal changes in the rules for 1882 have been in water-tight bulkheads, of which more are now required in longer and larger vessels, and they are to be extended to the principal upper deck.

Vessels of extreme proportions (over 11 depths in length) have to be better strengthened in their top and bottom members, by doubling strokes, etc.

Treble riveted butt-straps are required to a greater extent, as forming stronger joints.

The rules for boilers, machinery, pumping arrangements, spare parts for machinery, etc., have been extended and improved, with a view to greater safety at sea.

As ship-building of steel is increasing, a reduction of 20 per cent. from the scantlings required for iron is permitted, giving ships so much more carrying capacity. A complete set of rules for testing all materials insures uniform quality in steel used. Steel castings, by the Siemens-Martin or Bessemer process are also now used, in place of large and expensive forgings, for stemports, rudders, stems, etc., and they have been found strong and tough; they are less expensive than scrap-iron forgings, and the risk of bad welds and inconvenience of rough and uneven shape is avoided.

The latest circular issued by Lloyd's Register offers to fix a proper load line for each vessel, according to its style, form, etc.; thus the rules not only provide for its proper strength, but also its sea-going qualities, etc. This is of the greatest importance in view of the many disasters that have occurred from the want of those qualities.

Mr. Haug also exhibited and described drawings of his own and other valve gears.

The one patented by Mr. Haug belongs to that class in which the longitudinal and lateral motion of an eccentric or other rod are both utilized for obtaining a variable cut-off and reversing motion. In comparison with F. C. Marshall's and Joy's valve motions, which have both been extensively used, this valve motion consists of fewer parts and joints, can be more compactly arranged, and has the least amount of motion to all its parts, being thus more accessible for oiling, etc. Compared with the link motion, it is considerably simpler, has less friction (all sliding friction being replaced

by bolt friction), requires less force to reverse, and will consequently throw less strain on all its members.

Mr. Charles G. Darragh read a paper entitled, "Some Notes on the Pollution of Water," in which he said :

The water supply of most of our cities, excepting perhaps Brooklyn, is affected in one or more ways, and often where large sums of money have been expended to obtain pure water, particularly in New York, Boston and Baltimore (having a gravity supply).

Water may be contaminated naturally as well as artificially.

Artificial contamination under the general head of sewage should be prevented.

Natural mineral contamiuation must be treated either chemically or mechanically. Natural organic contamination is produced by decaying plants, algæ and other organisms. Shallow reservoirs, tidal streams and marshes induce the growth of vegetation, which dies in the fall and allows the hot rays of the sun to kill the algæ, both of which, while decaying, produce a disagreeable taste and smell.

The water in deep reservoirs is also affected. Perfect decomposition of decaying organisms seems to be prevented in the lower strata when the temperature is lower and the air has been expelled by compression, for upon exposure to the air and motion, gas is eliminated and the offensive taste and smell dispelled.

Water in dead ends of street mains is generally in this condition.

As examples of contaimination due to shallow water, swamps, etc., we have Boston, New York, and Frankford reservoir, the latter receiving its water from the Delaware River, Philadelphia, while the deep lying strata of water in Tumbling Run dam on the Schuylkill, and Druid Hill Reservoir, Baltimore, illustrate deep water pollution. The paper also explained how, if the sewage was kept out of the Schuylkill, it would under natural condition give a purer water than the Delaware; also that the Schuylkill water from Fairmount Pool, contaminated as it is by sewage, will keep in storage reservoirs better than Delaware water taken from Lardner's Point, where there is but little sewage contamination.

The paper also suggested how collecting reservoirs should be built to abate the trouble spoken of.

HOWARD MURPHY,
Secretary and Treasurer.

Record of Regular Meeting.

November 18, 1882, President Rudolph Hering in the chair. Twenty-three members present.

Mr. Chas. W. Pusey presented a paper upon the Twin Screw Steamer "Victoria." On Tuesday, Nov. 7, this steamer sailed from Wilmington, Del., for Greytown, Nicaragua. This vessel is a light draught twin screw steamer for service on Lake Nicaragua, and of a class that is attracting some attention from those interested in the economical transportation of freight on bays and rivers, where the draught of water is limited, and where the side-wheel steamer is principally used.

The hull is of iron and is 136 ft. 6 in. in length over all, 26 ft. beam and 7 ft. deep above cross floors. The model is the same as that of several side-wheel steamers built for service on rivers and bays in South America and Mexico. She has one fore and aft bulkhead in centre, and four athwartship, all made water-tight. The compartment aft is fitted for water ballast to trim the vessel. The frame is of angle iron. The machinery consists of two compound engines with cylinders 12 in. and 21 in. in diameter by 18-in. stroke, fitted with jet condensers. The engines are independent, each driving a propeller wheel 6 ft. in diameter. She has two steel boilers of the locomotive type, fitted for burning wood and constructed for a working pressure of 100 lbs. per square inch. The finished draught of water, with five tons of coal in bunker, was 4 ft. 6 in. aft, and 3 ft. 6 in. forward. On trial trip, with a draught of 5 ft. 4 in. aft and 2 ft. 10 in. forward, she made a speed of ten knots per hour, with 119 revolutions per minute, 94 lbs. 26 in. vacuum; total indicated horse-power 246. During the trial the ballast tank was filled with water.

When she sailed for Greytown she had a cargo of 105 tons of coal, also merchandise and stoves amounting to about 20 tons more, the draught of water being 6 ft. 3 in. aft and 5 ft. forward. Under these conditions, going down the bay she made 9½ knots per hour, with 80 lbs. steam pressure and 108 revolutions per minute.

Prof. L. M. Haupt presented a profusely illustrated description which he has been compiling for some time, of the progress of early American wooden bridge building. Reference was made to the well-known structures of Schaffhausen, 1758, and Wettingen, both destroyed by the French in 1799, and to the remarkable bridges by Wernwag, between 1804 and 1812. A summary of the typical forms as represented in the Burr, Town, Haupt, the Longs, Howe & Pratt trusses was then given with illustrations and reference to the works of Mr. Chevallier, Lavoinne, Pontzen and others.

Attention was called with regret to the fact that the best illustrations and data with reference to engineering works of America were generally only obtainable only from foreign sources.

The paper gave rise to a general discussion, in which Messrs. Cleemann and Graff cited instances of early suspension bridges (Mr. Graff presenting the Club with a photograph of a painting, showing the old suspension bridge at the Falls of Schuylkill, Philadelphia), and reference was made to the early floating draw constructed by the late Henry R. Campbell, at Rouse's Point; also to a wooden truss said to have been built about 1809, over the Terrebonne River, near Montreal, Canada, of 600 ft. span, but of which no very authentic data could be obtained.

A communication from Mr. M. Coryell was received through Mr. Wm. A. Ingham, describing the early structure built by Wernwag, at New Hope over the Delaware, with illustrations of several of the Wernwag bridges. The description was in the handwriting of Mr. Ingham's father, then president of the bridge company.

HOWARD MURPHY,
Secretary and Treasurer.

LIVERPOOL ENGINEERING SOCIETY.

At a meeting of the above society, held at the Royal Institution, Colquitt street, on Wednesday evening, 8th inst., Mr. F. B. Salmon, President, in the chair, a paper, by Mr. C. E. Hannaford Shid, M. Ins't C. E., on the "Testing of Materials for use in Engineering Structures," was read. In the paper the author, for want of space, deals only with two classes of materials, viz.: Limes and cements and metals. He selected these on account of there being many differences of opinion, with respect to some of the methods of testing, and, therefore, will, he hopes, leave more matter for a discussion thereon. After relating briefly the usual tests applied to hydraulic limes, with a view of ascertaining their quality, he passed on to Portland cement. On dealing with this material, reference was first made to the different methods of manufacture, after which he described at some length the various tests to which it should be subjected, including compressive and tensile strength, fineness of grit, weight, color, etc., and then pointed out that by actually breaking sample, by either tension or compression, is given the most reliable information of its quality. He then described and showed, by the aid of diagrams, the various forms of briquette which have been used at various times, giving the reference to the last form introduced by the Metropolitan Boards of Works, as being the one, he believed, calculated to give the most accurate results. He then entered at some length into the various methods of making the briquette, the amount and nature of the water found most beneficial under different conditions, and other details, and concluded this section with some remarks on the utmost necessity in comparing the relative strengths, and other properties of two or more samples, that all the details of gauging and manufacture should be as nearly as possible identical. In dealing with the section on metals, the author described the various, but usually applied, tests to cast and wrought-iron and steel, pointing out several tests which, although occasionally resorted to, are, in his opinion, to be condemned. In referring to the forge test of these last two metals, he quoted the latest tests required by the Admiralty for these metals, and concluded this section with a review of the connection which exists between the chemical and mechanical qualities of iron and steel.

PROPOSED NEW RAILROADS IN VERMONT.

A House bill, introduced by Mr. Fairbanks, of St. Johnsbury, is in amendment of the charter of the St. Johnsbury & Lake Champlain Railroad. It authorizes the building of a branch road from Concord up Moose River, through Granby, East Haven, Brunswick and other towns to Canaan. Some four miles of the road have already been built under the general law. The proposed road lies through a vast lumber region, and its construction will open up a section from which millions of feet of valuable building material will be produced.

The bill to incorporate the Coos Valley Railroad Company has become a law. The charter contemplates building a railroad from some point in the town of Guildhall, Essex county, on the line between the State and New Hampshire, westerly through the towns of Maidstone, Brunswick, Bloomfield, Lemington and Canaan, to the northerly line of the State. The capital stock is fixed at $500,000. This proposed road will open up and develop a great lumber section. House bill 280 extends the chartered rights of the Bridgewater, Plymouth & Ludlow Railroad ten years.

A bill has passed both houses incorporating the Rutland & Tidewater Railroad Company. The proposed road runs from Rutland through Ira, Castleton, West Haven, Fairhaven and Poultney to the western boundary of the State.

The act to incorporate the Brattleboro' & Bennington Railroad Company passed both houses unanimously. The construction of a narrow-gauge road from Brattleboro' to Wilmington has long been agitated by the people living along the line of this proposed road. Several surveys have been made and the route is pronounced a feasible one. The needs and demands of the people along the line are urgent for the building of this road. The distance by the surveyed lines is some 20 miles. Capitalists and prominent business men of the section are back of the enterprise and it will doubtless be pushed to a successful end. Towns along the line are authorized to aid the road by bonding. This part of the county is a fine farming section, and railroad facilities will supply a want long felt. The road will first be built to Wilmington and may ultimately be extended to Bennington.

Railway corporations may be organized and roads constructed under the general law without special charters or specific legislation. Towns are authorized to aid in railroad enterprises by bonding to an amount not exceeding eight times its grand list (the list being one per cent. only of the total property valuation.)

The people of the State have little cause of complaint against the management of the various railroads. The managing officials are uniformly courteous and obliging to the public and the roads are run as a rule for the comfort, convenience and safety of the patrons. Railroading in Vermont is accompanied with difficulties and drawbacks not experienced in less mountainous and more thickly populated States, and the exigency does not seem to have arisen to necessitate such sumptuary and hostile legislation as is proposed in several of the bills mentioned.—*Montpelier Correspondence Boston Journal, Nov.* 18.

GOING WEST.

(From "Topics of the Times," in the Dec. Century.)

The young man in the older communities of the East, reading of the marvelous growth of this new western country, often asks himself whether he could not wisely join the ranks of the next annual migration. No doubt the question, "Shall I go West?" is the uppermost problem in the minds of thousands of the young men of the East, who have still their careers to make, and have not yet gained a secure and promising footing in the business world. It is a question which each must answer for himself, and concerning which no advice can be given that would be of universal application. It would be a grievous mistake to suppose that a change of longitude alone insures success. Idleness, incompetency, and a nerveless, drifting disposition have no better chance in Montana than Massachusetts. Indeed, there are some men who run along fairly well in the East, in the grooves of custom and established acquaintance and business connections, who would make lamentable shipwreck if set adrift in a new Western community.

On the other hand, the chances for a young man of average pluck and energy are unquestionably much better in the West than in the East. He shares the advantages of being among the first to open a fresh store-house of natural wealth. He gets the first dividend on the increase of value resulting from bringing population upon the soil. The land he buys for three or four dollars an acre, or gets for nothing by homestead settlement, soon becomes worth ten or fifteen. If he embarks in trade or in any mechanical pursuit, his wares or his services are in brisk demand, because all the new-comers around him require goods and implements. Then there is a certain stimulus in the moral atmosphere caused by the ambitions and energies of a new community full of hope and activity, which makes hardships easy to bear and causes buoyancy of spirits.

Western people find it hard to make their friends in the East understand just what they mean when they speak of the difference in the business and social tone of the two sections. It is a difference to be felt rather than defined. There is vastly more energy and more hope *per capita* of the population in new communities than old, and the immigrant feels at once the resulting stimulus. It braces up the listless and the desponding, and makes even the most active man conclude that there is a deal more in him in the way of work and ideas than he supposed. Many a young man would have remained a clerk or small-salaried employé of some kind all his life, had he stayed in the East, becomes, amid the larger opportunities of the West, a "leading citizen," and the owner of a fine farm or a prosperous business.

The young man going West, can therefore, count upon the opportunities of obtaining good land at small cost, the business openings growing out of the wants of a new community, and the moral incentive that comes from contact with hopeful, enterprising people. If he does not succeed in gaining a full measure of independence in the

course of ten years, the reason will lie in his own disposition. He will either lack energy and capacity, or he will be so much a creature of habit and so thoroughly the outgrowth of an older civilization that he cannot adjust himself to the new environments. There are men, as well as trees, that will not thrive when transplanted. The intending emigrant would do well to study his own disposition carefully, and make sure that he is not of that kind.

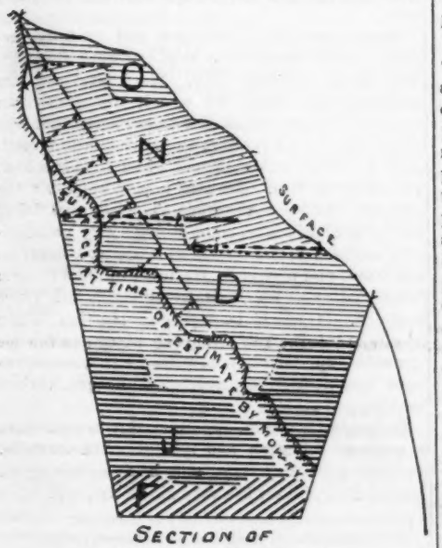
CORRESPONDENCE.

DIFFICULT EARTHWORK MEASUREMENTS.

YELLOWSTONE DIVISION, N.P.R.R.,
BILLINGS, Mon., Nov. 16, 1882.

EDITOR ENGINEERING NEWS:

While agreeing with Mr. Mowry, in his article of November 11, in that it is no easy task to take measurements for monthly estimates on rock side cuts of 135 feet, may I ask, is not his section at time of estimate left in a very ragged condition, or why permit the station to be worked in such a manner as to require an "assistant to lower himself with a rope hitched from above, and with a graduated pole measure the *ordinate* from the cord?" May I suggest that by using a *templet*, or wooden triangle, with base and perpendicular in proportion to the slope of the cut, in connection with line and bob to bring one side in plumb, the hypothenuse, which will equal the desired slope, may be applied by the laborer himself as the excavation is in progress, thus maintaining, as he should, a uniform and regular surface as an unbroken retaining wall. May I presume to say that a contractor who would create such gouges as appear 15 feet below the slope stake in Mowry's cut, should receive the most severe censure from his engineer, and certainly should not expect the benefit of measurement as is indicated by the ordinate; also, a contractor should finish the slope as his work proceeds, and for his own convenience will maintain a nearly level working surface, which will remove much of the trouble complained of in taking the estimate, and reduce the area to a system of triangles and parallelograms that may readily be computed by referring to the plotted cross-section, on paper especially prepared for that purpose, which is a most satisfactory and a very correct method of portraying the cut. Of course these measurements are taken as the surface requires. In this the curved or warped lines of Mowry's section will be eliminated. Straight lines drawn from point to point of measurement, agreeing with height and distance, will be substituted.



SECTION OF MOWRY'S CUT.

From my observation, slopes are usually taken out as in areas O . N . D . J . F. in which the letters and quantities they represent indicate each month's work and is the Cross-Section from which the assistant must compute his quantity for estimate. Thus, two methods are available. He can obtain the necessary data by a line of levels from some B. M.; or, by dropping his tape-line from the already located slope-stake, the distance to a convenient point being noted, the measurements for irregularities are carried on by slope-rod and loaded tape, all of which are carefully noted in the field book, and in the office are lightly penciled on the cross-section sheet with a scale correspondingly graduated, from which he can with confidence make up his estimate, also check the contractor's slopes and define the geological strata for classification. In our practice, on slopes of 144 feet, a measurement from slope-stake to line of work only, and scaled on the cross-section as mentioned, is often the only needed data required, as an underestimate is desirable, and especially so during the commencement in taking down a slope, which, together with a percentage held for faithful performance and completion of work, enables the engineer in charge to protect the interests of his patrons, and deal equitably with the laborer.

Respectfully, J. C. ISAACI,
Assistant Engineer.

New York, West Shore & Buffalo R'y,
RESIDENT ENGINEER'S OFFICE,
JERSEY CITY, Nov. 24, 1882.

EDITOR ENGINEERING NEWS:

The communication in your issue of Nov. 11, on "Difficult Earthwork Measurements," illustrates a method of "cross-sectioning" which, I think, deserves further commendation. To obtain the position of a point in a required cross section by means of its direction and distance from a known point, instead of by its vertical and horizontal distances from that point, will, in many instances, prove to be the easier and more accurate method, although the latter is generally adhered to—often, however at unnecessary expense of time and with poor results. In cross-sectioning tunnels and rock cuts with steep slopes—where many of the points are inaccessible to ordinary horizontal and vertical measurements—the use of a graduated arc of a circle in the following manner will be found to be very convenient, the arc being about 200° in extent and 2½ to 3 feet radius.

After running in center stakes where sections are required, the arc is, by means of suitable legs or braces placed in plane of a section to be taken, the 90° mark brought vertically over the center of circle and center stakes with plumb-bob, and the elevation of center of circle noted. The zero end of the tape is then successively carried to the points required in the cross section and their locations are obtained by drawing the tape tightly past the center of the circle, reading the angle on the arc indicated by the edge of the tape, and the distance on the tape to center of circle.

Having the circular form once set up, a large number of points can be located in a short time. I have taken cross sections of roof and sides of tunnel excavation in this way (the zero end of tape being carried on end of pole with a lantern), which, if obtained as accurately by horizontal and vertical measurements, would have required three or four times the amount of work.

Yours respectfully, W. H. ATWOOD,
Res. Eng. N. Y. W. S. & B. Ry.

SANITARY INSTITUTE OF GREAT BRITAIN.

EXAMINATIONS FOR LOCAL SURVEYORS AND INSPECTORS OF NUISANCES.

At an examination, held on the 2d and 3d, the following questions were set to be answered in writing on the 2d, and the candidates were examined *viva voce* on the 3d:

PAPER 1.—1. What are the chief sanitary Acts in force? (*a*) In the metropolis, (*b*) in other parts of England? What are their chief provisions?

2. What are the principal provisions of the model by-laws issued by the Local Government Board with reference to (*a*) building construction, (*b*) house drainage, (*c*) ventilation?

3. What is the primary principle to be observed in the drainage of a town or district, and how would you proceed to determine the size and capacity of the outfall sewer?

4. What rules should be adhered to in regard to gradients, manholes, lampholes, ventilators and flushing in a sewerage system? Illustrate your answer by sketches.

5. Describe the rules that govern the question of sewage disposal at the outfall.

6. How far is a separate system of sewerage desirable?

7. Describe the essential points to be observed in carrying out a system of house drainage. What are the desiderata of a good form of water-closet? Illustrate your answer by sketches.

PAPER 2.—1. What are the first considerations in designing and constructing water-works?

2. Describe the conditions to be kept in view in selecting a source of water supply.

3. How much water has been proved by experiment to be used per head in an average household by constant and by intermittent supply? Compare this with the average expenditure of a large town and explain the cause of the difference, if any.

4. Describe the best means of casting and testing water pipes, and of making joints.

5. What amount of cubic space per head is required for healthy sleeping rooms? Why is it necessary to have a certain amount? What limit of height should be allowed to reckon in the calculation?

6. Describe by a sketch the best transverse section of a paved and of a macadamized street, each 40 feet wide. How should macadam be formed and laid?

7. What is the most economical mode of watering and cleansing streets?

1. What are the provisions of the Public Health act with regard to cellar dwellings?

2. In inspecting a stream which is complained of as a nuisance, to what points would you direct your attention with the view of making a report?

3. Give the dimensions of a sleeping-room which you would consider suitable for six adults, and state your reasons.

4. Describe some of the simple forms of ventilating valves in general use, and explain their action.

5. In what ways may water become polluted after delivery into houses?

6. What are the objections to brick house drains? How should house drains be constructed?

7. What sanitary defects would you look for in inspecting a house where there has been a case of diphtheria?

8. What are the characteristics of various kinds of unsound meat and fish?

NEW PUBLICATIONS.

AMERICAN FOUNDRY PRACTICE.—By Thomas D. West. 361 pp. Illustrated. John Wiley & Sons, 1882. Price, $2.50.

The author has successfully endeavored to select such matter as would best explain difficult castings, and to offer practical molders problems for thought and study. Almost all the more important castings are illustrated by drawings made by the author.

From time to time during the past two years the original articles have been published in the *American Machinist*; they have been enlarged when deemed essential, and in some cases rewritten, until they form a complete treatise upon the subject of molding.

The following main divisions of the book present a good idea of the scope of the work: The Molder and the Foundry, Green Sand Molding, Loam and Dry Sand Molding, Manipulation of Iron Castings, Notes and Recipes.

THE PARIS SEWERS.

The so-called sewers under the city appear to serve little purpose but that of interesting British and American tourists, who delight in being rowed about down below in boats, and are always enthusiastic over the absence of evil smell in the handsomely vaulted and well-lighted passages through which they are conducted. Seeing that the offensive matter which ought to find its way into the sewers is cleared out of the houses at night and carried in carts through the streets, and that vegetable refuse and stale water are habitually thrown into the open gutters to poison the atmosphere, it is not surprising that the air should be, if anything, purer in subterranean Paris than in the magnificent thoroughfares on the surface. It would probably not be rash to ascribe the superior healthfulness of London, as shown by its exceedingly low death-rate, to the fact that the English capital is really drained, whereas Paris is drained only in name. The teeming slums in the east end; the multitudes of factories; the dense, foggy, sunless winters of London have no equivalent here, yet the average death-rate of the French capital, even when no epidemic is raging, is, compared with that of London as 29 to 18; but then if a French tourist were to venture into the great sewer of London he would probably not survive to tell the tale.—*London Telegraph.*

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.

S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, DECEMBER 2, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Terms of Advertising.—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

CLUBBING ARRANGEMENTS.

1883.

In order to accomodate such of our subscribers as may wish to subscribe for other periodicals we offer the following terms: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00, and the following at the additional prices given:

	Net Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
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Harper's Weekly	3.25	4.00
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Harper's Young People (weekly)	1.25	1.50
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Van Nostrand's Magazine	4.00	5.00
North American Review	4.00	5 00
Sanitary Engineer	2.75	3.00
Railroad Gazette (new subs.)	3.50	4.20
" " (renewals)	3.90	4.20
American Architect	5.00	6.00
Scientific American	2.65	3.20
Our Continent	3.25	4.00

The principal change in the above figures from those of last season is in that of the *Century Magazine*, which has advanced its trade price correspondingly. Our purpose is to bring the trade of our subscribers into this office, and to do this we give the clubbing journals at trade price and we add five cents to pay for stamps, stationery and time in handling the business. We wish it understood that we will extend this arrangement to any desired journal in the United States, so that our subscribers need not pay any attention to the claims of solicitors, who cannot offer any better terms.

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WE call attention to a valuable little collection of tables for railroad engineers advertised elsewhere this week. These tables, bound up in book form for convenience, are the property of the engineering department of the N. Y., W. S. & B. Ry. Co., and have been thus far distributed only to the engineers of that road. At our solicitation, however, a small edition has been ordered to be printed for general distribution without any reference to profit. The price has been placed at one dollar, and only a very limited edition will be printed for sale. We will fill orders only as long as the edition lasts.

THE GOVERNMENT ESTIMATES for public works for the fiscal year ending June 30, 1884, amount to $14,361,715. It is probable that the War Department will ask nothing for rivers and harbors, as there is a large surplus.

THE Chrismas number of *St. Nicholas* is, to our thinking, the most exquisite specimen of illustrated magazine literature that has ever been produced in any country. Besides the delicately colored frontispiece "On Christmas Day in the Morning," the eighty pages which make up this unrivalled holiday number, are literally crammed with the very finest specimens of the wood-engraver's art, an art, which it is now acknowledged the publishers of our leading magazines, presumably the the Century Company, have brought to a perfection unequalled in any other country. The *St. Nicholas*, while constituting a monthly "recreation" in art, contains also such recommendations to all lovers of charming stories that it cannot fail to please alike the parents and children wherever it puts in its monthly smiling appearance.

DYNAMITE IN POLITICS.

Dynamite has suddenly assumed a new importance, and become a political question in France. The uneasy politician of the past has become the daring and dangerous conspirator of the present, who uses an agent that leaves the gunpowder of Guy Fawkes by a few centuries, and many more points, behind. French ministers are in a quandary, and the *messieurs des ponts et chaussées* who were just laying out plans for boring a new tunnel through the Alps that would be superior to the Saint Gothard have been considerably non-plussed by a ministerial decree of Oct. 28 by which dynamite is placed under the *haute surveillance* of the police, and otherwise treated with the severity which dangerous characters bring upon themselves. There are no fewer than fifteen provisions in this law, and the legal formalities to be fulfilled are what may be termed vexatious. No longer than eight days storage or supply is allowed in any case, while the transport is so hedged in that only very small quantities can be taken at a time, thus immensely increasing the likelihood of accidents by the greater number of shipments. But the worst of it is the interminable red tape that has to be employed in order to get your dynamite, for it is well known that the French Circumlocutory Office can give even its English rival a point or two in the way of "how not to do it."

The measure has provoked a great deal of indignation among the numerous classes that require dynamite. One trade paper applies, and in no ironical sense, the term of "precious explosive," as if the distinctive name of "dynamite Nobel" was not already sufficient. For there are four of these dynamite companies and they seem to be prospering, if stock quotations can be trusted. The French Dynamite Company makes 110 francs this year, as against 60 francs last year. The Spanish Company has its shares at an equal advance. The great extension of public works in Mexico has given the Mexican Company a large and increasing market, while the Nobel (Fusion) Company is also prosperous. Dynamite, in fact, has become indispensable to the engineer of to-day, and the stupendous works of the last decade became possible only by its aid. It has conquered its place in the mine, the tunnel and the canal. It is a formidable weapon in offensive and defensive military action, and although it cannot be "buckstered" in the market-place it is quoted on "'Change."

But the very strength of dynamite may be said to be its weak point. It really is less dangerous than gunpowder. A spark will not set it off, but like the phlegmatic individual it is fearful when it receives the necessary incitement. Nitro-glycerine, dynamite, etc., have, however, a political history, which is exciting the hopes and fears of too widely different social classes. The killing of the Czar of Russia was the work of dynamite. The Nihilists have taken to it with their own peculiar enthusiasm, and now French and European socialists in general are looking to it as the great instrument for realizing their wild dreams. A large dynamite manufactory was recently discovered in Switzerland, and it is no exaggeration to say that there are good grounds for the uneasiness which exists in some of the European cities, at the terrible danger which it is possible for some devils in human shape to hang over them. Lately, in Lyons, a crowded restaurant was terribly shaken, and threats have been made to blow up theatres and generally, to smash up things. The terrible effects of nitro-glycerine in the Thomassen affair in the Bremen docks some years ago are still in the recollection of all—effects so terrible that the fiendish perpetrator committed suicide almost immediately afterwards. Dynamite, as one of the most powerful of known agents, should not be placed in the hands of ignorant or wicked men, and its manufacture should certainly be surrounded with precautionary restrictions. The criminal negligence which lately resulted in the extermination of a family in Pennsylvania is only a specimen of the reprehensible way of dealing with this explosive, and engineers and contractors would do well in their own interest to adopt the utmost care and caution with its handling. It is one of those articles of which a little goes a long way, and which will not be trifled with.

Some years ago an Irishman and his to-be-presumed gentle spouse were taking a walk along the Erie basin in Jersey City. The Celtic eye was attracted to a small tin vessel; the gentleman picked it up, and impelled by a curiosity that was rather idle than scientific, he undertook to investigate a certain yellow matter which, like a solder, ran along the rim. He used a pen knife for the purpose, and began to scrape—The lady was fished out of the basin after some trouble very considerably astonished, and doubtless laying the blame on her "lord and master." He, however, had his arm wrenched from his shoulder and was otherwise maimed. It would be a poor consolation to the victim to inform him that such tremendous force could be explained by chemists as the instantaneous combination of hydrogen, nitrogen, carbon and oxygen atoms.

Seriously, however, dynamite threatens to have a political evolution and revolution in its train. Perhaps some day there may be some new agent started that will set the very air on fire, and

> "Strike flat the thick rotundity o' the world,
> Crack nature's moulds, all germens spill at once,
> That make ungrateful man!"

PHILADELPHIA WATER-WORKS.

A "sub-committee on municipal abuses" of the Committee of One Hundred in the much governed City of Brotherly Love have requested Howard Murphy, Secretary of the Civil Engineers Club, of that city, to recommend a fitting man for the office of Chief Engineer of the Department. The *Evening Telegraph* of the 24th ult. contains Mr. Murphy's response to this rather delicate undertaking. Two very safe men—Mr. Frederic Graff and Mr. Isaac S. Cassin—meet Mr. Murphy's approval, and their names have accordingly been submitted to the committee. We give in our "Personal" column Mr. Murphy's sketch of the professional career of the two gentlemen named, either of whom, it will be conceded, may be considered sufficiently qualified for the office designated.

In his communication, Mr. Murphy specifies as follows: "Honesty, industry, and peculiar executive ability, and firmness in the management of men and things, are of the utmost importance, too, in that great department of this great city. There, the engineer should be the manager, and no one unprepared by this kind of experience, also, should be allowed the place." Now, if we are not very much mistaken, the present Chief Engineer, Dr. McFadden, possesses in an eminent degree these very qualifications; in fact he possesses them so markedly that the City of Philadelphia has been the gainer by hundreds of thousands of dollars during his administration, while the office-holding leeches that had previously fattened on the water

revenues have dropped off and are now doing their level best to turn the tables on the "Doctor" whose "executive ability and firmness" were too much for them and their "backers."

The word "Chief Engineer" like most other designations of Philadelphian office-holders is a misnomer. Dr. McFadden is properly the "Water Commissioner" and the office calls for "executive ability and firmness" more largely than it does for special knowledge of water-works construction and management. The real engineer of the Philadelphia Water Works is Mr. Chas. G. Darragh and a comparison of the condition of the Philadelphia Water Department now, and when Dr. McFadden was put in command will prove a record not to be ashamed of.

Can any Department in the City Government of Philadelphia be named that has not as its head, a politician rather than a man, who professionally might be considered the fitting person to fill the position—if so which is it?

PERSONAL.

W. F. GARIS is appointed chief engineer of the Burlington and Ohio River railroad, and will have entire charge of the construction of the road, subject only to the board of directors.

MR. FREDERICK GRAFF, whose honored father designed and constructed the original Fairmount Works (an engineering monument of their time), was their Superintendent before Consolidation. After Consolidation, upon the creation of the Water Department, which included the Fairmount and other works, he was made the first Chief Engineer, and served for the years 1854 to 1856. He was again elected in 1867 and served until succeeded by Dr. McFadden. He has since been engaged with the Worthington Pump Works, and, for many years, in various important engineering pursuits.

MR. ISAAC S. CASSIN was educated at Westtown school; served apprenticeship with Messrs. I. P. Morris & Co. as machinist and mechanical engineer; was engaged as Superintendent, 1852 to 1856, in construction of hydraulic and mining machinery and the introduction of the Cornish pumping engine; was Engineer of the Spring Garden Water Works, Philadelphia, 1856-57-58; Chief Engineer Philadelphia Water Department, 1862-63-64; Chief Engineer United States Mint, 1867-68-69, and has designed and constructed complete water-works at Chester, Oxford, Pottstown, Coatesville, Ashland, Media, Phœnixville, Conshohocken, Swarthmore and Louella, Pa.; Bridgeton, Burlington, and Salem, N. J.; Ithaca and Owego, N. Y., and New Castle, Del.; also, important parts of, or designs for, works at West Chester, Meadville, and Lancaster, Pa.; Lambertville, N. J., and Wilmington, Del.

GEN. DANIEL TYLER, a veteran United States soldier, died on Nov. 30, at the Fifth Avenue Hotel, this city, aged 83 years. He was born in Brooklyn, Conn., graduated from West Point, and was the oldest graduate of which there was any record. In 1828 he was sent to France by the government to study the improvements in the art of war; in 1834 he resigned from the service, and, turning his attention to civil engineering, he soon became extensively interested in railroading. He was the President of the Norwich & Worcester Railroad Company from 1840 to 1844, of the Morris Canal and Banking Company, of New Jersey, from 1844 to 1846, and of the Macon & Western Railroad Company, of Georgia, from 1846 until 1848. He was a member of the Board of Visitors to the Naval Academy in 1849, and from 1850 until 1861 he successively held the positions of Superintending Engineer of the Cumberland Valley Railroad, of Pennsylvania; General Superintendent of the Dauphin & Susquehanna Railroad & Coal Company, of Pennsylvania; Superintending Engineer, and afterward President, of the Auburn & Allentown Railroad, of Pennsylvania, and President of the Schuylkill & Susquehanna Railroad. He served through the civil war, and since its close has been interested in railroad and manufacturing enterprises. He was President of the Mobile & Montgomery Railroad from 1873 to 1878, and owned large interests in cotton mills and iron furnaces in Alabama.

SIGNAL SERVICE OFFICE NOTES.

An unpretentious but very useful little publication just issued from the Signal Service is that known as No. III. of the "Notes," which has been prepared by Lieut. James Allen. It is a pamphlet of eleven pages, whose purpose is to enable farmers and others who are engaged in the raising of crops to foretell—and, consequently, to guard against the effects of—frost. It is more particularly designed for the use of such persons as live in places not reached by the warning bulletins of the Signal Service. In determining whether a frost may be expected use is made of the well-known dry and wet bulb hygrometer, which consists simply of two similar thermometers, one of which has its bulb covered with a bit of muslin kept constantly moistened by being connected with a cup of rain or distilled water by means of a few threads of darning cotton or a narrow slip of muslin. The dryer the air the greater the evaporation from the wet muslin and the lower the reading on the scale attached to the wet bulb thermometer. This reading is subtracted from the reading of the other thermometer, and the difference is made use of, by reference to the table prepared for this purpose, in determining the dew point. The dew point indicates about the lowest temperature which will be reached during the night under ordinary circumstances. When the air is cooled down to this point dew is deposited and the latent heat given out arrests a further decline of temperature. When the air becomes warmer the loss of heat by radition from the plant and other surfaces speedily cools it, and the temperature, therefore, oscillates about the dew point. This point being ascertained, it is evident that the approach of forests can also be determined beforehand and precautions taken in time to prevent the doing of harm. A minimum thermometer for showing the lowest temperature is a useful adjunct to the hygrometer. The Signal Service Office is prepared to furnish to observers accurate instruments at the actual cost price. To insure accuracy the instruments should be kept in a shelter, designs of which are given in Lieutenant Allen's pamphlet, which also contains full directions for taking observations and for making the necessary calculations. By the issue of this pamphlet the Signal Service office does not intend to curtail any part of its system for frost warnings, which are to be this fall on a very extensive scale. Two special bulletins will be issued each each day, at 1 a. m. and at 10 a m., and will be sent by telegraph to the press, to exchanges, plantations, etc. How much the system is extended for the tobacco interests is shown by the fact that forecasts affecting the growth of "the weed" are to be sent to twenty-one distributing points in eleven different States and the District of Columbia, and from these points they are to be repeated at five hundred and sixty-nine other places.

THE EDUCATION OF ENGINEERS.

INDIANAPOLIS, Nov. 19.

TO THE EDITOR OF THE RAILROAD GAZETTE:

When I read your article of Nov. 10 on "The Education of Engineers," for which my letter of inquiry furnished the "excuse," I felt that mine was decidedly a case of "misplaced 'confidence'"—much as if I had sought light on a question of banking from an original thinker like Dennis Kearney, and been told, with some warmth, that, to begin with, banks, bankers and banking must go. Comment seemed useless, and I felt disposed to "change the subject;" but reading some letters in your paper of the 17th, just received, I am moved to ask space for "a few remarks."

I want to set myself and the "young man" right.

The "assistance" (from your putting it in quotation marks I suspect the word struck you with an emphasis not intended) was asked for, not "to aid the writer in advising a young man," but for the young man himself, whom the writer felt incompetent to advise.

The card of the writer does not advertise him as one of a firm "engaged in practical engineering work," but as a *contractor*.

The young man does not contemplate "a classical course at Oxford" or anywhere else, and he entertains no "foolish notions" whatever to justify the spirit and much of the matter of your comments on my letter. The things he has in contemplation are going into the field on surveys, or into a shop of some sort to work for wages, or entering a "mechanical school," where doubtless he thinks he can get, with some saving of time, a wider knowledge of materials, mechanical processes, etc., for a foundation on which to build hereafter, as opportunity shall permit or the nature of his untried work suggest. And he talks of attending scientific lectures in his hours of leisure and of getting incidentally more German and French, that he may have access to the technical works and journals of those languages.

In all this you may see "reasons for suspecting that he entertains illusions" of various sorts; but, as a matter of fact, he is a man bent on *work* towards an end, as he sees it; and the end he proposes to himself is "to be a civil engineer, and to make a specialty of railway construction and management."

Now, there was a gentle savage once (so Franklin says) who heard the missionary patiently on "Man's First Disobedience," and at the conclusion of the story observed, with native and untutored politeness, "What you say is true; it is indeed wrong to eat apples; better make them all into cider!" In the same conciliatory spirit I am disposed to admit that because the word engineer presupposes an engine, and for other reasons "too numerous to mention" (and with which also I am not acquainted), "engineer and all its derivatives" and combinations ought to be abolished—with the exception, mark ye, of mechanical engineer, which I would reserve for Matthias. Edmund must indeed eschew the addition civil engineer, though Angeline weep.

Webster (whom I never swear by on questions touching the nice use of words, except when he happens to agree with me) says a civil engineer is "a person skilled in the science of engineering, who designs and superintends the construction of public work or machinery," and, below, "civil engineering," he says, "refers, according to modern usage, strictly to the construction of *fixed* public works, such as railways, canals, bridges, light-houses, sewers," etc. Now what our "young man" wants to do is to become skilled in the science of engineering, and especially in that part of it which relates to designing and superintending the construction of railways. There are thousands of men doing precisely this sort of work throughout the civilized world. The thing exists, and needs no apology for its being, but it *does* need a name. These men are not stone-cutters, or pile-drivers, or section bosses, or contractors, or signal makers. Until you fill the void we are constrained to call them civil engineers.

It takes some dozens of different sorts of men to complete a great building. There are hod-carriers, stone-cutters, masons, carpenters, plasterers, iron-workers, etc., and finally an architect; and the chances are *no two of them, not even the stone mason, and the brick mason could change places*, and certainly no one *kind* of them could do the whole. Is it any disgrace, or even disadvantage to the architect, that he cannot carry the hod, or plaster the wall! If you would advise him to carry the hod as a part of his education, why not insist on his learning practically every one of the forty trades and callings represented on his building? Do you suppose that if you had all the rest you could build your building without the architect?

If you could "banish the term civil engineer" by an act of the legislature or an editorial in the *Railroad Gazette*, the difference would remain between the railroad grader, the mason, the pile-driver and the —— fellow who lays out the work for all of these and keeps a trained eye on the work as it progresses.

The engineer is the man to whom, not wholly but more than to any other, we owe the conquests that have been made within this century over material obstacles, the substitution of strain sheets for guesses, the abandonment of such wasteful use of material as may be seen in the Victoria Bridge, the substitution everywhere in his own broad province of definite knowledge and the clear purpose for confusion and blind groping. He has done much, and much remains to do; and he will do that best who brings to the work the formulated experience of his predecessors, a firm grasp on the principles they have painfully worked out, a good store of common sense, and much practice; but *practice in the strong light of all of these.*

There was a time when the physician was a barber, but medicine has made such progress since the two trades were divorced that they will never be reunited. It is not so long since the mason was the engineer, and since there was not much engineering science extant in those days, a knowledge of one's A, B, C's and the multiplication table might then have been a liberal education to start on. The oldest of our living engineers began with a slender equipment of theoretical knowledge, partly because there was nothing better to be had. But those of them whose work is a real legacy to their successors did not end so; and the young man who expects to build high in the profession of civil engineer *to-day* would best begin, as nearly as may be, where they left off. Every year now the necessity for a *solid foundation in science* ("*definite knowledge in contradistinction to that indefinite knowledge possessed by the uncultured*"—"I

thank thee, Jew, for teaching me that word") will be more apparent.

These are "glittering generalities." Had I been capable of anything much better I should not have called on you to assist our "young man."

I want also to join my protest to that of another correspondent against your "alleged" definition of success.

Would you button-hole a young man reading law and say to him, "see here, my young friend, what you want to do is to drop all this nonsense about 'principles' and 'philosophy of law' and all that sort. The less law you have the better; it is *petty juries* you'll have to deal with. Study human natures, its passions and prejudices. What you want to do is to *succeed*, win cases, get verdicts, get money; you *understand?*"

Would you say to the innocent who contemplates adopting the profession of medicine, "Now, my boy! bear this in mind, that a very little knowledge goes a great way in *that* trade. Just as soon as you know the difference between calamus and calomel, and can write a prescription that no one but a druggist can read, you sail in and *practice*. You will pick up the rest fast enough, and your success, that is your profit, will depend more on your *tact* in managing people than on *anything else*. If you want to get rich you must be *popular; that's* the point."

For God's sake! when you see a young man putting his heart, his brain and his hands into work, bent on doing it *well*, don't pluck him by the sleeves and whisper in his ear the mercenary wisdom (?) which old age and hard knocks have brought you—and may, perhaps, bring him soon enough—to all our loss.

The "young man" we are talking about wants to succeed *and* to make money; but to make it as a civil engineer.

S.,
Contractor.

Yᵉ OLDE-TIME SURVEY.*

One hundred and forty-seven acres 3 roods and 19 rods, after deducting whatever swamp, water, rock and road areas there may be included therein and all other lands of little or no value, the same being part of said deceased's 1,280-acre colony grant, and the portion hereby set off being known as near to and on the other side of Black Oak Ridge, bounded and described more in particularly as follows, to wit: Commencing at a heap of stones about a stone's throw from a certain small clump of alders, near a brook running down off from a rather high part of said ridge, thence by a straight line to a certain marked white birch tree about two or three times as far from a jog in a fence going around a ledge near by, thence by another straight line in a different direction around said ledge, and the "Great Swamp" so called, to a corner of the "King lot" so called, thence in line of said lot in part, and in part by another piece of a fence which joins on to said line, and by an extension of the general run of said fence to a heap of stones near a surface rock, thence as aforesaid to the "Horn," so called, and passing around the same, as aforesaid, as far as the "Great Bend," so called, and from thence to a squarish sort of a jog out in another fence, and so on to a marked black-oak tree with stones piled around it, thence by another straight line in about a contrary direction, and somewheres about parallel with the line around by the ledge and great swamp to a stake and stone bounds not far from the old Indian trail, thence by another straight line on a course diagonally parallel or nearly so with "Fox Hollow Run," so called, to a certain marked red-cedar tree out on a sandy sort of a plain, thence by another straight line in a different direction also to a certain marked yellow-oak tree on the off side of a knoll with a large flat stone laid against it, thence after turning around in another direction and by a sloping straight line to a certain heap of stones which is by pacing just 18 rods and about one-half a rod more from the stump of the big hemlock tree where Philo Blake killed the bear, thence to the corner begun at by two straight lines of about equal length which are to be run in by some skilled and competent surveyor so as to include the area and acreage as hereinbefore set forth.

* Copy of a mutual distribution by Probate Records of Connecticut in 1812.

MEAN ANNUAL RAIN-FALL.

We make the following abstracts from a paper written on this subject by Prof. Elias Loomis, of Yale College, and read before the recent meeting of the National Academy of Sciences. From the observations made and recorded it appears that on one-fifth part of the land surface of the globe the average annual rain-fall is less than 10 in., and that on even a larger surface the fall is so slight as to render the land valueless for agricultural purposes, except in the limited districts which permit of irrigation. There is an extensive rain belt along the Atlantic coast from 35° north to 33° south, with the exception of districts in Mexico and Texas, where the average rain-fall is 50 in. There are belts of country across South America, and Africa and the islands of the East Indian Archipelago which form an equatorial rain belt of about 1,000 miles in breath where the rain-fall averages 50 in. There are also similar belts across Africa, Asia, and in sections of Australia, North and South America, where the rain-fall averages only 10 in. and even less, but the only portion of Europe which is properly termed a rainless district is a small portion of Spain, where the fall is less than 10 in. per annum. The most remarkable rain belt extends from the Atlantic coast across Northern Africa and eastward to the Indus, its length being 4,500 miles and its breath 1,000 miles, in which the rain-fall is about 75 in. Prof. Loomis drew no deductions from his observations, but, in a paper read later on, Prof. Guyot, the geographer of Princeton College, read a paper on the existence in both hemispheres of a dry terrestrial zone. These dry or rainless zones, whose location were vaguely designated in Prof, Loomis's paper, were more distinctly marked out on a map exhibited by Prof. Guyot. These zones he denominated as semi-tropical zones, and are situated both north and south of the equator, extending across a well defined belt of country. The southern semi-tropical zone is nearer to the equator than the northern semi-tropical zone, a fact which the professor held was due in part to the fact that the amount of land in the northern hemisphere overweighted that in the southern, and so lifted further to the north the whole meterological system of the southern hemisphere. The cause which leads to the existence of these two rainless zones is the construction of the country bounding them. The country about the partial deserts existing is such as to draw from the atmosphere all the moisture it has before the winds reach the dry country. This is generally the cause, the most notable exception being in the dry lands of Peru, where, though there is no rain, there is much moisture in the atmosphere, which is precipitated, and serves its purpose without condensation. In the course of his remarks he stated that the Mississippi Valley would be, by reason of the construction of the country on either side, a vast desert were it not for the existence of the Gulf of Mexico, the warmest body of water on the face of the earth, and one that helps very materially in supplying the rain-fall for that part of this country.

THE MEANING OF AN "INCH OF RAIN-FALL."

It appears that in the west and southwest of England the amount of rain measured in the course of the past fortnight has been just about double the average for the entire month of October, while over the Midland and Southeastern counties it has been about half as much again as the monthly average. In London rain has fallen every day, and on five days out of the fourteen the amount has been at least half an inch, the aggregate for the period being about 4¼ in. To the ordinary unscientific individual, whose notions on the subject of rainfall are, as a rule, somewhat vague, an inch or two more or less of rain may appear a trifling matter, and 4¼ in. in a fortnight a comparatively insignificant amount. Few persons are aware that an inch of rain over an acre of ground means 101 tons, or 22,623 gallons of water. Accepting as correct the Registrar-General's estimate of the gross area of London and its immediate suburbs, it would therefore appear that an inch of rain over the London district weighs in round numbers 45,000,000 tons, and amounts to the overwhelming volume of 10,000,000,000 gallons of water. With these figures in mind, the serious effects produced by a sudden downpour, such as we occasionally get in thundery weather, or by a long-continued spell of wet such as we have recently had, do not seem at all surprising. Estimating the total amount of rain in London during the past fortnight as 4¼ in., and applying this amount to the above figures, we find that the weight of water which has fallen has exceeded 190,000,000 tons, while in volume it has amounted to 42,500,000,000 of gallons. In attempting to grasp such enormous numbers, the mind becomes lost, but some idea of the immensity of the volume may be gained by imagining it all to be concentrated into one reservoir or basin. Supposing such a reservoir to be square and 40 ft. in depth, the sides of the square would be more than 13,000 ft. in length, and a walk round it would entail a journey of very nearly 10 miles. If we imagine the water to be inclosed in a cubic vessel, the sides of such a receptacle would be each about 1,896 ft. long—*Daily News of London.*

We learn that a large city, which is in need of the services of an expert civil engineer, for special work, is sending letters to a number of such persons, asking their terms. This is a penny wise and stupid way of doing business, and suggests a very low order of intelligence on the part of municipal authorities. Engineers of ability and reputation are not to be obtained by this kind of dickering.—*Sanitary Engineer.*

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

HYDE PARK, ILL., NEW GAS WORKS. The Chicago *Times* notes the sale of certain land to the Metropolitan Gas Company and gives the following account of the organization: "This purchase was made as the first step towards actual operations by the Metropolitan Gas company, organized in May, 1881. In May, 1881, the newly-organized company applied to the board of trustees of the village of Hyde Park for a charter to erect gas-works for illuminating, heating, and mechanical purpcses, and intended to supply that village with gas. As responsible parties in this city were shown to be interested, and pledged to see the works built and operated, it took little argument to obtain the charter and a contract to supply all the gas needed for the purposes named. Since the obtaining of the charter the gentlemen originating the enterprise have placed the stock among themselves and other local capitalists, who have aid in a working capital, and the work of erecting the works will commence immediately. The capital stock is $500,000. No plans have as yet been determined further than the following: The entire ground purchased will be improved with the buildings. These will be of very handsome design. First-class talent will be employed upon the plans, and the works will be such as to be an ornament of the beautiful suburb and a credit to Cook County. They will cost, as estimated, from $325,000 to $250,000. Fifteen miles of main will be put in without delay, and if it is possible to work without intermission though the winter it will be but a few months when gas will be supplied all over the village, not only as light but for heating purposes. The process will be either the Lowe water, the Springer, or other late process. The one which will furnish the best quality of gas at the lowest price will be adopted. It is designed that the general style of the buildings and the character of the whole plant shall equal anything in the west. The entire arrangements will be made known in a week or two."

WORK on the artesian well at Steelton, Pa., has been suspended at the depth of 720 ft. A pump was inserted, but the flow is not up to expectations.

TANK AT MANCHESTER, VA.—The tank on the water-tower which has been erected on the premises of the Richmond & Danville Railroad Company, near the Free bridge, is to be 16 ft. high and 20 ft. across the brim. It will hold 500,000 gallons of water. The structure is 85 ft. high, and several of the lower stories will be used as shops and offices.

THE MANCHESTER, VA., RESERVOIR was cleaned recently, about 40 cartloads of muddy *débris* being removed.

AN ARTESIAN WELL.—LINCOLN, Neb., Nov. 21.—Workmen excavating a well for a water-works to-day struck an artesian vein 40 ft. from the surface of sweet, pure water in inexhaustible supply. The water rises to 5 ft. of the surface of the ground, and insures the prompt construction of water-works for the city.

THE CITY SOLICITOR of Lynn, Mass., has decided that the Council has no authority to supply Swampscott with water. That town will have to look for some other source.

ELECTRICITY.

THE certificate of incorporation of the Colombia & Venezuela Telephone Company has been filed in the office of the Clerk of Monmouth County, at Freehold, N. J. The company has a capital of $100,000, and will build and operate telephone lines in the United States of Colombia and Venezuela.

A TELEPHONE CABLE.—The Southern New England Telephone Company laid a 21-wire cable across the Thames River, from Winthrop Point to the Groton shore, thereby putting the States of Massachusetts, Connecticut and Rhode Island on speaking terms.

ELECTRIC LIGHT IN MEXICO.—On Nov. 20, the plaza of Monterey was lighted by electricity for the first time.

ELECTRIC LIGHTS FOR HELL GATE.—WASHINGTON, Nov. 25.—The extreme estimates of the Electric Light Company for lighting Hell Gate by electricity are $14,000, which amount includes the erection of the proposed tower and furnishing the light. The contract will probably be awarded at that figure.

RAILROADS.

The circulation of false news to bolster up the credit of new railroad enterprises is an industry which some people have practiced with great assiduity of late years. Three or four persons with very little money and no credit start a new railroad enterprise. They have a survey made, and take care that every smallest step be heralded throughout the country. Apparently the various press associations and their correspondents in the country accept and forward any news of the kind if those who furnish it will pay for telegraphing, on the theory that editors will use their discretion in publishing what is sent them; but as the editors must often depend upon their agents on the spot to judge of the importance and especially of the accuracy of the news sent them, they are likely to publish what is sent them as important news. In this way the newspapers sometimes become, as it were, the decoys in a great confidence game. The railroad projectors in search of capital or credit, and not able to obtain either on the merits of their enterprise as presented to capitalists, use every exertion to spread the opinion that their road is wanted badly by some corporation or interest that can pay well for it. It is telegraphed all over the country that Vanderbilt wants it and Gould wants it, to-day that this one

is likely to secure it, and to-morrow that the other is making a better offer; and after a month or two of this lavish use of the telegraph, the name of the enterprise becomes familiar in the public mind, and many come to regard a preliminary survey and a few miles of grading as an established company, to which it will be safe to sell rails and rolling stock and perhaps to lend money.

And this use of the telegraph to magnify the importance of a company is not confined to new companies. Some companies with roads in operation (whose managers usually have a load of stock or bonds to sell) somehow manage to have the most trifling facts that may tell in its favor published far and wide, together with various rumors as to the great things it is going to do, the importance of a new connection likely to be negotiated, or of a new line which it contemplates building. And in most cases these roads and projects concerning which so much "news" is published in the newspapers are among the most worthless in the country. When we find telegrams week after week announcing that Gould and Vanderbilt are contending for the possession of some unbuilt line in Illinois or Iowa, we may safely infer that some one is very anxious to sell the line, and that if he does not sell he will have great difficulty in getting money to build his road.—*Railroad Gazette.*

NEW RAILROAD COMPANY.—The Secretary of State of Illinois has granted corporation papers to the South Chicago Elevated Railway Company; capital, $2,000,000. Articles have also been filed by the Albion, Carmi & Shawneetown Railway Company, to be constructed from Olney, Richland County, via Albion, in Edwards County, and Carmi, in White County, to Shawneetown, principal office in Carmi; capital stock $1,000,000; also by the Effingham & Northwestern Railroad Company; this road is to be constructed from Effingham, in the county of Effingham, Ill., to a point on the Toledo, Cincinnati & St. Louis Railroad, between Stewardson & Cowden, in Shelby County, Ill., principal office at Effingham; capital stock, $200,000.

THE Atlantic & Pacific have completed their road 403 miles west from Albuquerque, New Mexico, and have 157 miles yet to reach the Colorado River, where they are to meet a branch of the Southern Pacific. The Southern Pacific have their track completed 64 miles east of Mohave.

A BIG INCREASE OF CAPITAL STOCK.—MONTREAL, Nov. 28.—The Canadian Pacific Railway Company to-day raised its capital stock from $15,000,000 to $100,000,000.

THE BOSTON *Journal* says that the Oregon Short Line will stop at Boise City, not continuing to Baker City, as was intended, and that when any future extension is made it shall be in the direction of Portland and Central Oregon.

WISCONSIN NOTES.—A dispatch from Milwaukee states that the Chippewa Falls & Superior line of the Chicago, St. Paul, Minneapolis & Omaha Railroad has been completed to Hudson. The Bayfield line will be finished to Ashland by Jan. 1. Both lines secure to the railroad company two valuable land grants in Northern Wisconsin—that of the old Chicago & Superior Line Company and what is known as the Northern Wisconsin grant. The connections between the road named and the Northern Pacific at Superior are finished.

A NEW RAILROAD FOR STATEN ISLAND BEGUN.—Ground has been broken for the new railroad to run from West Port Richmond across Staten Island, through Richmond to Eltingville. It is to be called the North & South Shore Railroad of Staten Island. The road is expected to be completed by May next. A hotel and large wharf will be built at Prince's Bay. It is the intention to run fast express trains morning and evening, so that the trip from the southern terminus to New York by rail and boat can be made in fifty minutes,

THE Canadian Pacific Railway has its track laid a distance of 584 miles west of Winnipeg. Graders have reached a point 45 miles farther, and within 45 miles of Saskatchewan crossing and Medicine. Fifty-five miles of rail will yet be laid this season, and the road to the river graded during the winter.

THE INDIANA & OHIO RIVER.—TALBOT, Ind., Nov. 25.—Engineer R. A. Hamilton, of the Chicago, Indiana & Ohio River Railroad, arrived here with his corps last night on the line to Terre Haute. This will make a direct line from the coal-fields to the lakes.

ANOTHER RAILROAD IN MAINE.—A petition has been addressed to the Legislature of Maine by the inhabitants of Poland, Gray and neighboring towns, praying for a charter for a railroad from some place near Mechanic Falls, about twenty miles southerly to a junction with the Maine Central Railroad near Gray. This would be a prolongation of the line of the Rumford Falls and Buckfield Railroad, which would thus secure a new outlet to Portland and furnish railroad facilities to a new tier of towns. The road is now in operation from Mechanic Falls to Canton, twenty-seven and a half miles, and the proposed extension would make a line of about fifty miles.—*Portland Press.*

A WORK OF NECESSITY.—Some time since the Chesapeake, Ohio & Southwestern Railroad changed the gauge of their road on a Sunday, and the Grand Jury of Caldwell county indicted the company for the performance of labor on Sunday. Judge Grace, at Princeton, O., on Thursday decided in favor of the company.

THE track on the Woodstown & Swedesboro Railroad, New Jersey, is laid beyond Woodstown, and will be completed about the 15th of December. Leach & Baldwin are the contractors.

A GOOD LOCOMOTIVE RECORD.—N. Taft took engine No. 38 to run out of Susquehanna shop in the year 1868, and give it up Oct. 21, 1882, on account of putting hard-coal burners on the passenger trains. He has run engine 38 4,491 times over the Delaware Division (New York, Lake Erie & Western)—which is 105 miles long—making a grand total of 471,555 miles run—which only lacks 3,445 miles of running 19 times around the world. The engine is in good condition now, and with proper care it will last two years yet. There has been nothing new put on No. 38 since it ran the first trip except a pilot, tank frame, cylinders, and the usual every day repairs to the engine. It has the same cab, headlight, bell, drivers and tank that were on the engine when he took it.—*Port Jervis (N. Y.) Gazette.*

MICHIGAN CENTRAL.—The Detroit *Post and Tribune* says: "General Manager H. B. Ledyard, of the Michigan Central Railroad, returned from New York Tuesday night, at which point he has been for the past ten days, and brought with him the plans and specifications for the new Michigan Central depot. The design, which is by an Eastern architect, is intended to meet every requirement, present as well as future, and in an artistic sense will be a credit to the corporation and Detroit. The dimensions over all will be 184 by 400 ft., and the depot building proper with all the various offices is to be 100 by 184 ft., three stories high, and will occupy the southwest corner of Third and Woodbridge streets. Adjoining the above on the west will be a two-story building, and a one-story coach or train sheds will cover the passenger platforms between the tracks. The latter will be uncovered. It is intended that passengers shall pass from the waiting rooms and ticket offices of the main building through a vestibule to the trains, which will be separated from the depot proper by fences, as greater security and regularity are thus obtained. The entire structure, including sheds and annexes, is to be built of brick, with brown stone trimmings, and at an estimated cost of $175,000. It is intended to have the building completed in ten months' time, and the work of removing the present structure will commence at once. The architect is expected to arrive the early part of next week, and will then proceed to elaborate the general plan of the building more fully than has yet been done."

A PULLING TEST OF STANDARD AND NARROW GAUGE ENGINES.—Railway men have been much interested in seeing the pulling capacity of standard and narrow-gauge engines tested, side by side. The St. Louis, Iron Mountain & Southern and the Texas & St. Louis (3-feet gauge) roads have parallel tracks at Bird's Point, opposite Cairo, from the transfer wharf at the river running up the bank with a grade of about 190 ft. to the mile, and with two degree curves. The Texas & St. Louis has four rails—for 3 ft. and 4 ft. 8½-in. tracks—and it has been hauling up standard gauge cars with a narrow gauge engine. This engine, a consolidated, with cylinders 14x20 and eight drivers of 36 in. has pulled with ease up the steep incline six broad-gauge cars five of them loaded with 15 tons each and one with 23 tons, making a total of 98 tons, while the Iron Mountain engine, a consolidated "pony," with cylinders 17 x 22 and six 4½-ft. drivers, has hard work to pull an equal load, and frequently finds three or four cars sufficient. The narrow-gauge men are enthusiastic about the power of their engines, and claim that the moguls could pull up eight loaded cars, if the cars as well as the engine were on a track of 3 ft. gauge. This engine has a rigid wheel base of 14 ft. 7 in., and weighs about 28 tons loaded. She has pulled up this incline 8 narrow gauge cars loaded with about 15 tons of dirt each. Thus far the little narrow gauge more than holds her own against her bigger—or wider—competitor in respect to capacity and economy. Connotton Valley and Toledo and St. Louis stockholders should derive encouragement from this test of the respective gauges.—*Boston Journal.*

TUNNELS.

TUNNEL COMPLETED.—A note from Walter Katté, chief-engineer of the New York, West Shore & Buffalo Railway, dated Nov. 24, says: "I have just received a dispatch from West Point stating that the entire excavation of the tunnel is completed, and that the last brick in the arching of the same will be completed by noon to-morrow."

CANALS.

EAD'S SHIP CANAL.—A dispatch to the *World* from St. Louis says that Captain Eads stated that he has so enlisted English capital in his Tehuantepec Ship Canal project that the completion of that work does not depend upon any action Congress may take in the proposition he submitted at the last session.

CONTRACTS LET.

BRIDGE CONTRACT LET.—The Department of Public Parks of this city has let the contract for building the iron superstructure of the Madison Avenue bridge to the Keystone Bridge Company for $159,389.40.

CONTRACTING.

THE UNION IRON AND STEEL COMPANY.—CHICAGO, Nov. 18th, 1882.—Dear Sirs: This company now have in use your Asbestos and Hair Felt (Double Air Chamber) Covering on Steam Pipes, aggregating over twelve thousand (12,000) square ft. of surface.

I think the combination a good one, and am so well satisfied with the results, that I am having all of our new pipe-connections covered in the same manner as fast as they are completed. Yours, very truly,

R. R. JONES, Gen. Supt.

H. W. JOHNS, Esq., New York.

BUILDING.

THE *Lancet*, in noting the tendency in London to substitute flats for private houses, calls attention to the bad sanitary condition of most of the existing apartment houses, and warns the public against such future modes of construction as will expose occupants to the danger of sewer gas and difficult ventilation. The servants' quarters in existing flats are specially referred to as liable to engender disease, as they are either without windows or are "ventilated" by a hole over the kitchen sink.

BIDS FOR GLASS.—Bids were opened at the Treasury Department on the 23d ult., for furnishing glass for the public building, at St. Louis, as follows: Semon, Bache & Co., of New York (for imported glass free of duty), $5,139; F. A. Drew, St. Louis, $7,175; N. J. De Paw, New Albany, Ind., $7,225; E. A. Boyd, New York, $7,411, and for imported glass, $4,830; William Glenny, Cincinnati, $7,850; London & Manchester Co., of New York, $8,235, for imported glass, $4,971; Drey & Kahn, St. Louis, $8,252; Heroy & Mariner, New York, $8,701, for imported glass, $5,441.

BRIDGES.

ORDERS have been presented to the Boston Board of Aldermen authorizing the city treasurer to borrow $400,000, to be expended in "rebuilding, relocating and widening Warren bridge and the avenues leading thereto."

THE PENN BRIDGE WORKS, Beaver Falls, Pa., are now engaged in manufacturing 24 spans iron bridges for the Pittsburgh, McKeesport & Youghiogheny R. R. They also have a considerable amount of bridging on hand for the Pittsburgh & Western R. R., as well as a large number of highway and city bridges They have recently closed the following contracts: five bridges in Union County, N. J., as follows: for city of Rahway, one span 60 ft. with two 20 ft. roadways and two 10 ft. walks and one span 55 ft. with 30 ft. roadway and two 10 ft. walks; for village of Plainfield, one 45 ft. span with 22 ft roadway and two 7 ft. walks; for Clark Township, two 75 ft. spans, with 20 ft. roadway; also with city of Milwaukee, Wis., for two 120 ft. spans with 18 ft. roadway and two 6 ft. walks.

MISCELLANEOUS.

BIDS FOR STEAM-HEATING APPARATUS.—Bids were opened in the office of the Supervising Architect of the Treasury on Nov. 22 for steam-heating apparatus for the post-office and subtreasury at Boston, Mass., as follows: Walworth Manufacturing Company, $28,863; Q. M. Evans, $28,980; Nason Manufacturing Company, $30,250; Frederic Tudor, $30,600. The contract will be awarded to the Walworth Manufacturing Company.

PROPOSALS WANTED.—Gen. J. C. Duane, Engineer Third L. H. District, will receive proposals at the office of Light-House Engineer, Tompkinsville, Staten Island, N. Y., until Dec. 20, from iron manufacturers only, for the construction of the iron work of two light house towers and one pier. The towers and pier will be formed of cast-iron plates, bolted together. The towers will weigh about 60 tons each and the pier about 55 tons. Plans and specifications can be seen at the office of the Light-House Engineer.

TRUSS-BRIDGES.*

AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS-BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.

By F. B. Brock, Patent Attorney, Washington, D. C.

May 19, 1843, John R. Remington, of Alabama, invented a means of increasing the effective strength of timbers or beams used in bridges.

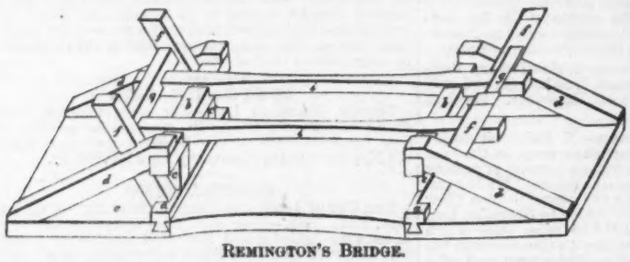
The nature of the device, so the inventor says, consists in so arranging the timbers as to avoid their tendency to break in the middle of their length, and this is effected by extending the ends of the timbers beyond the point of support, and there bracing or tying them down so as to render the points of support fulcra. The tendency to break is thus in part transferred to the points of support. Remington states that "it will be evident that thus supported the timbers cannot break in the middle without breaking also the two points of support."

The bridge is made to depend wholly upon the longitudinal sleepers *i i*. A cross-sill *b*, supported on piles *c c*, constitutes each pier. The extended ends of the sleepers beyond the piers are tied down by cross beams *g g*, and inclined braces *f f*.

This principle is intended to be applied under various

* Copyright, 1882.

modifications requiring either length or strength of timbers. Jointed piers may be used, so that the weight of the bridge shall tend to separate the piers at their upper ends, and thus



REMINGTON'S BRIDGE.

stretch the piers longitudinally. The bottoms of the piers are jointed so as to permit sufficient play for the purpose.

April 4, 1844, Thomas W. and Caleb Pratt received protection for a truss bridge, which protection was subsequently extended seven years from the 4th of April, 1854.

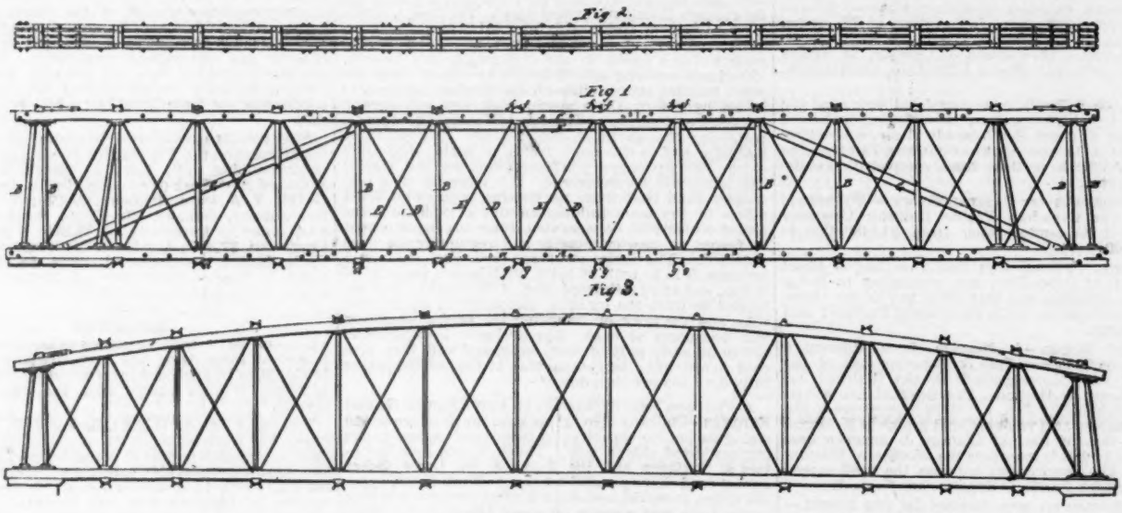
Where great strength is required a beam *F* is arranged directly under and in contact with the upper stringer, as seen in Fig. 1, and from each extremity of this beam an inclined beam *G* may extend to the lower string.

This system of bracing and counterbracing affords a means of regulating the camber of the bridge, and allows it to be drawn up or depressed in any particular segment, and thus furnishes a means of regulation not derivable from the then common single tension braces in each panel.

George W. Thayer, of Massachusetts, by letters patent, dated April 22, 1845, built a bridge of the appearance shown by the drawing.

a represents the upper chord, *b b* the chord bolts, *c c* are straining pieces interposed between the posts, *d d* are the principal diagonal braces stepped as shown by the drawing, *e e* are the counter braces, *f f* the floor beams, *g* the lower chord or string, and *h h* auxiliary braces.

Wooden trusses constructed generally like this bridge are

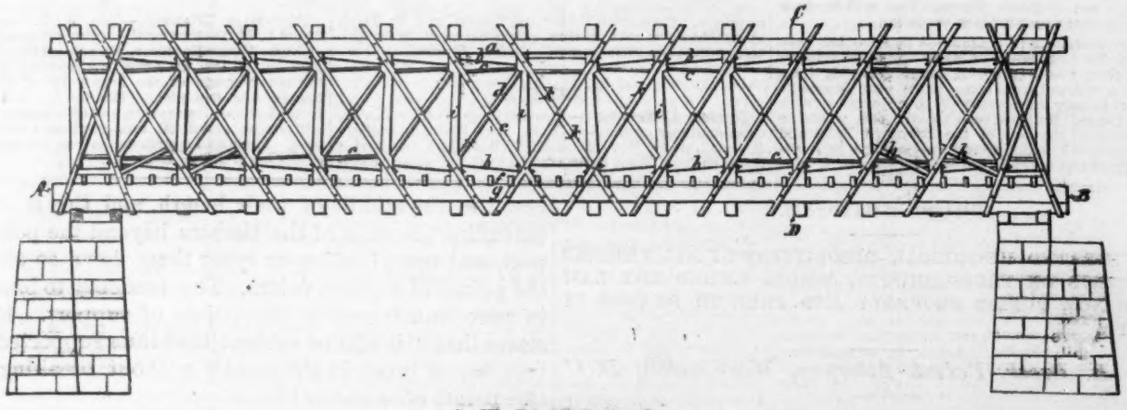


T. W. & C. PRATT'S BRIDGE.

A represents the inferior or lower chord, composed of a number of timbers *a a* arranged side by side, and spliced and bolted. The posts *B B* are elevated upon this chord and rest upon the shoes *b*, which extend laterally across the chord, and notched into the same. Similar shoes *c c* are placed on the top of the posts to receive the superior chord *C*, which is constructed in the same manner as chord *A*. It may be arched, however, as seen in Fig. 3.

all more or less subjected to settlement between their pieces or supports, by reason of the action of the peculiar strains exerted upon their chords in such manner as to draw apart from each other the timbers. This tendency is prevented by means of two series of iron screw-rods or bolts *b b*, the one being arranged directly under the upper chord and the other above the lower one.

If any sagging occurs between its points of support it may



G. W. THAYER'S BRIDGE.

The main braces *D D* and counter braces *E E* extend through the lower block *d d* under the posts through the upper blocks *e e* of the upper chord, where it is formed with a head *f*, its lower end having a screw and nut *g* to give it the required tension.

be overcome by screwing up the nuts of the iron rods *b b*. The suspension pieces of the truss will thus be kept in their places and the chords prevented from drawing apart longitudinally.

(TO BE CONTINUED.)